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IN THE VICINITY OF
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AND
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LONGLAC, ONTARIO 1988

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LONGLAC, ONTARIO 1988

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May 1989

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INTRODUCTION

Snow sampling surveys were carried out in Longlac in February, 1983 and February, 1986, near the Weldwood of Canada Ltd. waferboard and plywood mill, and the Kimberly-Clark of Canada Ltd. sawmill. This work was done in response to complaints from area residents of smoke and particulate fallout caused by emissions from these two sources. The surveys confirmed that the conical wood waste (teepee) burners operated at these mills were the sources of airborne particulate matter.[1,2]

Kimberly-Clark closed its Longlac sawmill in May, 1987, for economic reasons. The proposed installation in 1986 of a fluidized bed reactor to burn wood waste at Weldwood was cancelled due to economic restraints. Instead, a waste energy drying system, consisting of drum dryers and cyclones, was installed. This system was expected to significantly reduce emissions from Weldwood. To document the effects of these changes on local air quality, a third snow sampling survey was carried out in February, 1988.

METHODS

Single samples of snow were collected on February 23, 1988 from 17 sites around the teepee burners (Figure 1) and from one control site remote from the study area. Core samples of the complete snow profile were obtained following standard Ministry sampling procedures.[3] Meltwater was submitted to the Ministry's Thunder Bay and Toronto laboratories for determination of carbon (total particulate carbon, dissolved inorganic carbon and dissolved organic carbon), solids (suspended solids, dissolved solids and total solids), conductivity, tannins and pH.

RESULTS AND DISCUSSION

Results from the 1988 survey are presented in Table 1, along with data from 1983 and 1986. In 1988, the most significant change from 1983 and 1986 was the sharp decline in particulate carbon and suspended solids in snow near the closed Kimberly-Clark sawmill. These substances decreased significantly at sites 1, 2 and 5 (on-property sites), and at sites 7 and 8 (off-property sites). Contaminant levels at most other sites were similar to those found in 1986 and were lower than levels reported for 1983. Elevated concentrations of solids and carbon were found at off-property sites 15 and 20. Because insoluble particulate matter at site 20 comprised mostly grass and sand particles, industrial activity is not implicated as the reason for high solids and carbon at this location. Grass was also found in snow at site 15, but wood char and wood fibres were also present. The latter two substances likely resulted from emissions at Weldwood.

Snow contaminant guidelines for carbons, solids and conductivity were consistently exceeded in snow on Weldwood's property. Concentrations at off-property sites sometimes moderately exceeded guidelines. Levels of snow meltwater pH were significantly higher than the control value at all sites. Highest pH occurred at sites nearest Weldwood. Levels of tannins were negligible except at sites close to Weldwood.

The deposition rates of total solids in snow were calculated. Based on data from the Geraldton weather station, snow was on the ground for 96 days prior to our 1988 survey. The comparable period for the 1986 and 1983 surveys were 87 days and 73 days, respectively. Deposition rates of carbons and solids for each of the three surveys are shown in Table 2. These data reveal that fallout levels were

acceptable off company property around the two plants. Figures 2 and 3 illustrate the decline in deposition rate of total solids in the study area from 1986 to 1988. Contaminants were distributed in a bi-modal pattern in 1986. This pattern changed in 1988 when the Kimberly-Clark sawmill was no longer an emission source.

Correlation matrices for the 1988 data are presented in Table 3. The strong positive relationship between carbon, solids, conductivity and pH suggest that these parameters were associated with a common source. The strong negative relationship between these parameters and distance from Weldwood implicates Weldwood as the principal source of particulate fallout. No complaints of particulate fallout have been received from area residents in recent years.

CONCLUSIONS AND DISCUSSION

A snow sampling survey was carried out around the Kimberly-Clark sawmill and Weldwood waferboard and plywood mill in Longlac in February, 1988. Results confirmed that Weldwood was the only remaining source of airborne particulate matter in the area. Deposition rates in 1988 met the Ontario air quality objective for dustfall at all sites off company property. Snow contaminant guidelines were significantly exceeded only on Weldwood property. On Kimberly-Clark property and at off-property sites near both mills, guidelines were met or only moderately exceeded. Contaminant levels near Kimberly-Clark fell sharply in 1988 compared with 1983 or 1986. Concentrations at other locations were lower than levels in 1986 and were similar to concentrations found in 1983. The cyclone system installed at Weldwood in late 1986 has apparently improved local air quality.

REFERENCES

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2. Racette, D.J. and H.D. Griffin. 1987. Air quality studies in the vicinity of Kimberly-Clark of Canada Limited and Weldwood of Canada Limited, Longlac, Ontario. Ontario Ministry of the Environment.

3. Ontario Ministry of the Environment. 1983. Field investigation procedures manual. Phytotoxicology Section, Air Resources Branch.

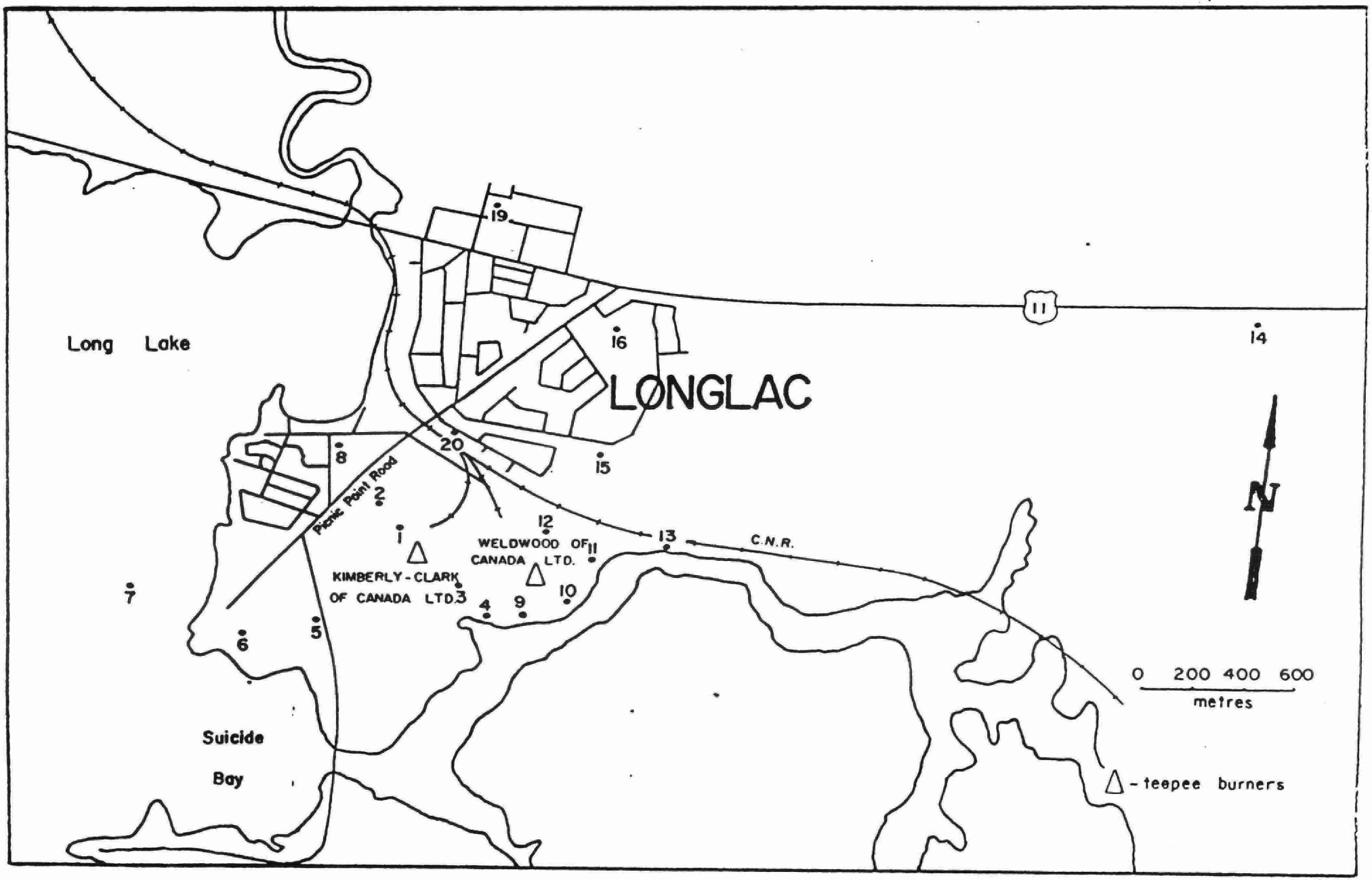


Figure 1. Snow sampling sites, Longlac, February, 1988.

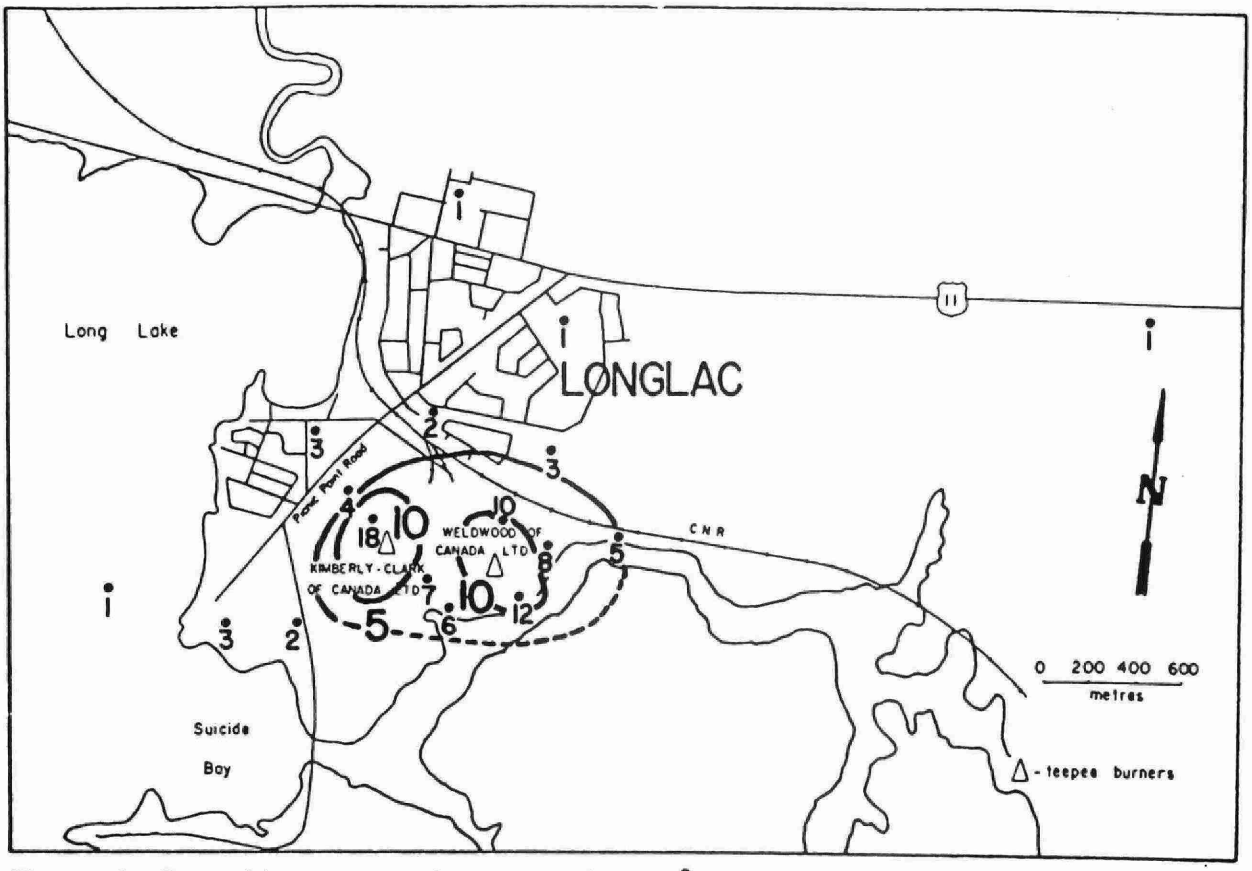


Figure 2. Deposition levels of total solids (g/m^2/30 days) in snow near Weldwood and Kimberly-Clark, Longlac, 1986.

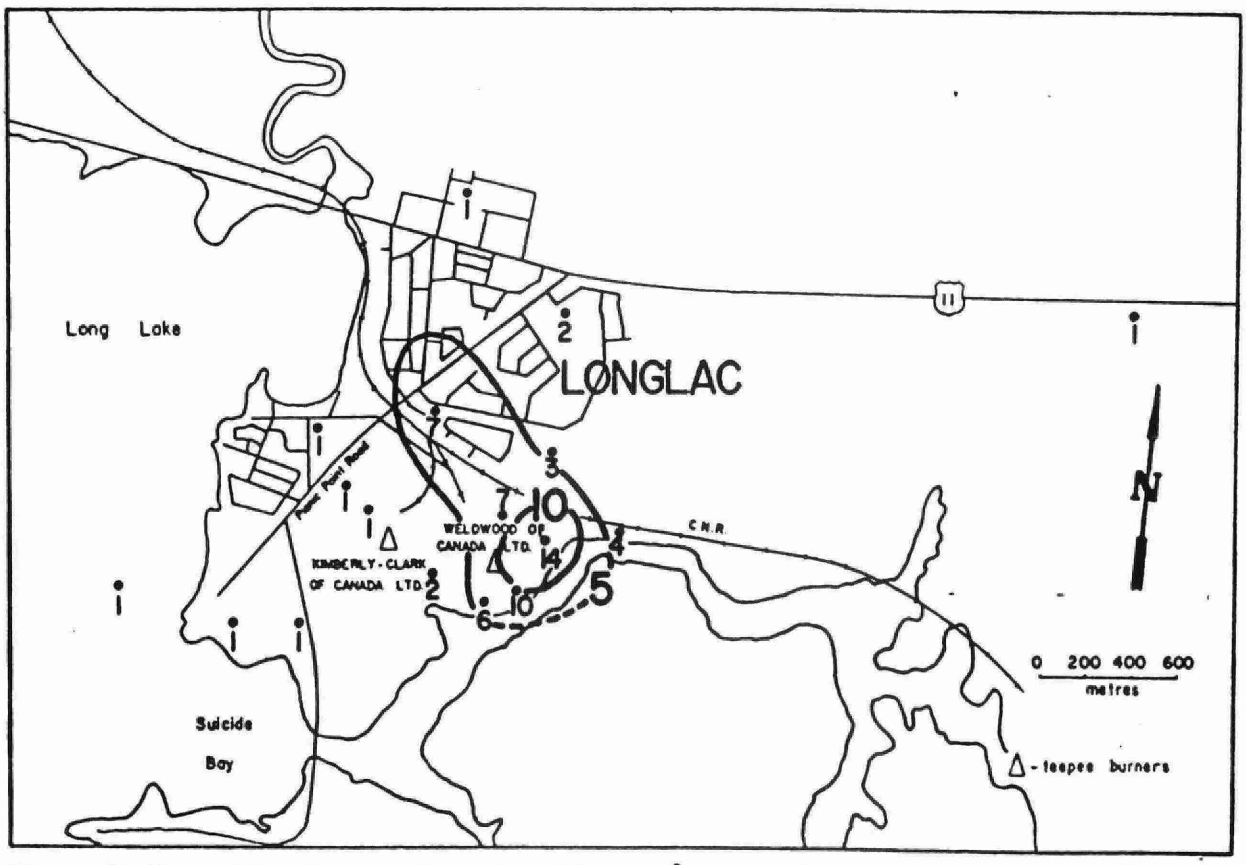


Figure 3. Deposition levels of total solids (g/m^2/30 days) in snow near Weldwood and Kimberly-Clark, Longlac, 1988.

TABLE 1. Comparison between levels of particulate carbon and solids (both in mg/l), conductivity (in umhos/cm), and pH in snow collected in the vicinity of Kimberly-Clark and Weldwood, Longlac, 1983, 1986 and 1988.

Site	Particulate carbon			Total solids		Suspended solids			Conductvity			pH		
	1983	1986	1988	1986	1988	1983	1986	1988	1983	1986	1988	1983	1986	1988
1[a]	64[b]	280	6	600	25	84	520	15	16	86	16	6.4	7.4	7.0
2[a]	15	54	6	120	25	26	96	15	12	36	19	6.3	7.7	7.1
3[a]	34	81	33	270	150	50	210	90	25	53	56	7.6	8.9	9.3
4[a]	36	100	37	200	160	48	150	90	28	47	75	8.3	9.2	9.7
5	31	34	5	150	25	44	110	10	21	33	27	7.0	7.9	9.2
6	29	28		91	25	56	67	15	22	24	15	6.9	7.4	7.0
7	12	14	2	68	10	20	46	4	10	25	8	5.5	6.9	6.3
8	8	30	6	78	20	16	56	10	13	21	20	6.4	7.1	7.4
9[a]	68					140			84			10.0		
10[a]	49	140	71	400	280	85	310	150	38	89	93	8.7	10.0	9.9
11[a]	76	100	52	900	340	140	740	130	46	170	96	9.0	10.3	10.1
12[a]	63	36	69	350	220	120	270	160	51	80	97	9.1	9.5	10.1
13[a]	16	6	30	130	160	27	97	95	23	49	48	7.4	9.6	9.4
14			5		25			15			48			7.2
15	21	11	29	67	160	36	41	60	24	26	49	6.8	8.2	9.3
16	20	2	11	45	65	36	27	25	20	21	30	6.9	7.3	8.0
19		18	6	23	35		9	15		18	23		6.9	7.5
20		6	25	55	270		32	50		29	42		8.3	9.1
Controls	<1	5	2	12	10	6	6	4	8	16	13	5.2	6.2	4.6
Guidelines		7		40			25			45			-	

[a] Sites on Kimberly-Clark or Weldwood plant property.
[b] Values above contaminant guidelines are underlined.

TABLE 2. Deposition levels of carbon and solids ($g/m^2/30$ days) in snow collected near Kimberly-Clark and Weldwood, Longlac, 1983, 1986 and 1988.

Site	Particulate carbon			Suspended solids			Total solids	
	1983	1986	1988	1983	1986	1988	1986	1988
1[a]	1.7	9.0[b]	0.2	2.3	16.0	0.6	18.3	1.0
2[a]	0.7	1.9	0.1	1.2	3.6	0.3	4.2	0.5
3[a]	0.9	2.1	0.4	1.4	5.4	1.2	6.9	2.0
4[a]	1.0	2.8	1.4	1.4	4.2	3.3	5.7	5.7
5	1.3	0.5	0.1	1.8	1.8	0.2	2.3	0.6
6	0.6	0.9		1.1	2.2	0.5	3.0	0.8
7	0.3	0.3	<0.1	0.5	0.9	<0.1	1.3	0.1
8	0.3	1.1	0.2	0.7	2.2	0.3	3.0	0.5
9[a]	0.2		3.9					
10[a]	0.1	4.5	2.5	2.2	9.9	5.4	12.3	9.9
11[a]	2.9	1.0	2.2	5.4	7.1	5.4	8.4	14.4
12[a]	1.7	1.0	2.3	3.3	7.2	5.4	9.6	7.2
13	0.5	0.2	0.8	0.8	3.3	2.4	4.8	4.2
14		1.2	0.2		0.4	0.5	0.8	0.8
15	0.8	0.4	0.6	1.5	1.6	1.2	2.6	3.3
16	0.6	<0.1	0.3	1.0	0.6	0.7	1.0	1.8
19		0.4	0.2		0.2	0.5	0.5	0.1
20		0.2	0.7		1.1	1.3	1.9	7.2
Controls	<0.1	0.2	0.1	0.1	<0.1	0.1	0.1	0.3

[a] Sites on Kimberly-Clark or Weldwood plant property.
[b] Values exceeding the provincial air quality objective (7.0 $g/m^2/30$ days)

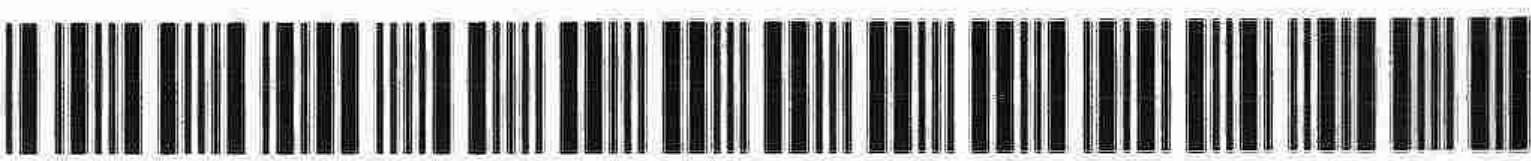
TABLE 3. Correlation matrix of concentrations of selected parameters in snow meltwater and distances from Kimberly-Clark and Weldwood Limited, Longlac, February, 1988.

	Carbon	Solids			
	PTC[c]	RST	RSP	Cond.	pH
RST[a]	.87*				
RSP[b]	.99*	.87*			
Cond.	.94*	.85*	.94*		
pH	.84*	.84*	.85*	.86*	
Dist.-KC[1]	-.29	-.26	-.26	-.08	-.32
Dist.-W[2]	-.65*	-.62*	-.66*	-.49*	-.68*

*Denotes a significant Pearson correlation at the 95% confidence interval.

[1] Dist.-KC - distance from sampling sites to Kimberly-Clark's teepee burner.
[2] Dist.-W - distance from sampling sites to Weldwood Ltd.'s teepee burner.

[a] RST = total solids
[b] RSP = suspended solids
[c] PTC = total particulate carbon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